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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,283	02/09/2004	Masataka Sasaki	62807-160	3488
20277 7590 01/09/2007 MCDERMOTT WILL & EMERY LLP 600 13TH STREET, N.W. WASHINGTON, DC 20005-3096			EXAMINER KITOV, ZEEV V	
			ART UNIT	PAPER NUMBER
			2836	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		01/09/2007	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/773,283

Applicant(s)

SASAKI ET AL.

Examiner

Zeev Kitov

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 November 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 - 13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 - 13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 April 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

Examiner acknowledges a submission of the amendment and arguments filed on November 17, 2006. Claims 1 and 11 are amended. The Office Action follows.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (US 5,210,479) in view of Takanashi et al. (US 6,351,399) and Kohno et al. (US 6,180,966). Regarding Claim 1, Kimura et al. disclose following elements of the claim: a first comparator (elements 12, 13, 15, 23, 3 and 5 in Fig. 8), which detects a collector voltage of the power management semiconductor device and outputs a <sup>first</sup> ~~first~~ detection signal (base voltage of transistor 15 in Fig. 8) when the detected collector voltage exceeds a first reference voltage (voltage drop across element 14 in Fig. 8); a second comparator (element 31 in Fig. 8), which detects a gate voltage of the power management semiconductor device to output a second detection signal (collector current of transistor 31 in Fig. 8), when the detected gate signal exceeds a second reference voltage ( $V_{go}$ ), which is a minimum gate voltage for feeding a rated power to the power management semiconductor device. As to setting a value of the second

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reference voltage, it is clear that the second reference voltage is lower than the line power voltage of a drive circuit since the Kimura et al. et al. et al. circuit does not include any provision forcing voltage of any element of the circuit to exceed the power supply voltage value. Kimura et al. further discloses another limit to the second reference voltage, i.e. it should be higher than the final gate voltage terraced voltage (col. 9, lines 8 – 14). It further discloses logic equivalent means for outputting a protection start signal (collector current of transistor 15 in Fig. 8) when both the first and second detection signals are being outputted; and gate voltage reduction equivalent means (elements 16, 17, 18 and 6 in Fig. 8) reducing the gate voltage in accordance with the protection start signal from the logic means (col. 10, lines 7 – 55).

However, it does not disclose the second comparator detecting the gate voltage relative to the potential of emitter of the semiconductor device. Takanashi et al. discloses the second comparator (26a in Fig. 7) detecting the gate voltage relative to the potential of emitter of the semiconductor device (2U in Fig. 7, col. 16, lines 5 - 13). The reference is pertinent for the current case since it deals with protection of IGBT by measuring the gate potential of the switching transistor. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Kimura et al. solution by referencing the comparator to the potential of transistor's emitter, because (i) in Kimura system the driving circuit is biased with respect to the driving transistor by a value of bottom power supply (2 in Fig. 8), and therefore the negative voltage is applied to the gate of the transistor 19 when it is in off state (col. 4, lines 60 – 63), while in Takanashi et al. system the driving circuit (15 in Fig. 7) is

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powered by another source of power (17U in Fig. 7), which has a common connection with the main power supply feeding the switching transistor and therefore, the zero voltage is applied to the gate of the transistor (2U in Fig. 7) when it is in off state; the negative bias of the gate in the off state has some advantage when it is necessary to ensure very small value of leakage current in the off state, however, in most of industrial applications wherein there is no such requirement the Takanashi et al. supply system can be used, which is simpler and especially because it makes possible easy generation of different supply voltages by using the same main power supply source; accordingly, in such system the voltages are naturally referenced to a common zero potential, which is the switching transistor's emitter potential.

Additionally, it does not disclose the trench type power semiconductor device. Kohno et al. discloses the trench IGBT (Fig. 1 and 2). Both references have the same problem solving area, namely providing the power semiconductor devices, particularly IGBT. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Kimura et al. solution by adding the trench type IGBT according to Kohno et al., because as Kohno et al. state (col. 1, lines 18 – 24), such device has advantage of a low voltage drop in ON state, and accordingly, a low power dissipation.

Regarding Claim 3, Kimura et al. disclose the equivalent gate voltage reduction means (transistor 15 in Fig. 8) cutting off a drive signal of the drive circuit thus reducing the gate voltage.

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Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. in view of Takanashi et al., Kohno et al. and Marquardt et al. (US 5,650,906), As was stated above, Kimura et al. Takanashi et al. and Kohno et al. disclose all the elements of Claim 1. However, regarding Claim 2, they do not disclose the voltage divider. Marquardt et al. disclose detection of the over-voltages by using the resistive voltage divider (58 in Fig. 3, col. 2, lines 58 – 65). It is used for detection of the collector voltage of the IGBT. Both references have the same problem solving area, namely providing over-voltage protection for the IGBT devices. Examiner takes an Official Notice that some operational amplifiers (and comparators as well) allow only a limited voltage between inputs, sometimes as small as +/- 0.5 volt. Particular reference will be provided upon request. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have further modified the Kimura et al. solution by adding the resistive voltage divider to both the collector and the gate voltage detection according to Marquardt et al., because as Marquardt et al., state (col. 5, lines 27 - 33), "The voltage divider serves the purpose of adjusting the measuring range. The adjustment of the measuring range and a good frequency response can be realized by means of a suitable selection of the resistance values and a required division of the resistor 62 into a plurality of component resistors 66 connected electrically in series". Such adjustment is useful in measuring both the collector and the gate voltage of the IGBT.

Regarding Claim 4, Kimura et al. disclose the equivalent gate voltage reduction means (transistor 15 in Fig. 8) cutting off a drive signal of the drive circuit thus reducing the gate voltage.

Claims 5 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Taakanashi et al., Kohno et al. and Horowitz et al. textbook, The Art of Electronics. As was stated above, Kimura et al. and Takanashi et al. disclose all the elements of Claims 1 – 4. However, regarding Claims 5 – 8, they do not disclose the first reference voltage as being lower than the line power voltage. Horowitz et al textbook demonstrate that the collector voltage may go beyond the power supply voltage due to inductive load reaction (pages 52 – 53). However, according to them, it may cause breakdown of the switching transistor. Therefore, the switching transistor is to be protected against voltages exceeding the normal power supply value. Therefore, the first reference voltage used to detect departure of the collector voltage from normal predetermined value in the Kimura et al. circuit must be lower than the line power voltage. Both references have the same problem solving area, namely protecting the power switching transistors. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Kimura et al. solution by setting the first reference voltage lower than the line power voltage, because otherwise the protection circuit of Kimura et al. will become useless.

Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. in view of Takanashi et al. and Kohno et al. Claims 9 and 10 differ from Claims 1 and 2 rejected accordingly by their limitation of both comparators, logic means and gate voltage reduction means and drive circuit being integrated into a single semiconductor integrated circuit. Today it is common practice in the electronic industry to integrate semiconductor circuits into a common package, i.e. integrated circuit. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Kimura et al. solution by integrating all the parts of the circuit, except the IGBT, into a single integrated package, because (i) it will reduce the cost, increase the reliability and improve the environmental protection of the circuit and (ii) according to Court Decision *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) stating: "that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.").

Claims 11 – 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wacknov et al. (US 6,812,586) in view of Kimura et al. Takanashi et al. and Kohno et al. Wacknov et al. disclose following elements of the claim: the converter including a power semiconductor device for converting DC current to AC current (element 374 in Fig. 10); a power management semiconductor device (inherent in the structure of the load converter 374 in Fig. 10), which controls a switching operation of said power semiconductor device (elements 514 in Fig. 10). It further discloses an equivalent of

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computer processor means for controlling the ON/OFF operation of the power semiconductor device (330, 332 in Fig. 4). However, it does not disclose the protection circuit for power semiconductor devices. Kimura et al. disclose the protection circuit for power semiconductor devices including: a first comparator (elements 12, 13, 15, 23, 3 and 5 in Fig. 8), which detects a collector voltage of the power management semiconductor device and outputs a first detection signal (base voltage of transistor 15 in Fig. 8) when the detected collector voltage exceeds a first reference voltage (voltage drop across element 14 in Fig. 8); a second comparator (element 31 in Fig. 8) which detects a gate voltage of the power management semiconductor device to output a second detection signal (collector current of transistor 31 in Fig. 8), when the detected gate signal exceeds a second reference voltage ( $V_{go}$ ), which is a minimum gate voltage for feeding a rated power to said power management semiconductor device or over; logic equivalent means for outputting a protection start signal (collector current of transistor 15 in Fig. 8) when both the first and second detection signals are being outputted; and gate voltage reduction equivalent means (elements 16, 17, 18 and 6 in Fig. 8) reducing the gate voltage in accordance with the protection start signal from the logic means (col. 10, lines 7 – 55).

As to referencing the comparator to the emitter potential of the switching transistor, this issue was addressed above (see Claim 1 rejection). As to setting a value of the second reference voltage, it is clear that the second reference voltage is lower than the line power voltage of a drive circuit since the Kimura et al. circuit does not include any element forcing voltage of any element of the circuit to exceed the power

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supply voltage value. Kimura et al. further discloses another limit to the second reference voltage, i.e. it should be higher than the final gate voltage terraced voltage) (col. 9, lines 8 – 14).

Both references have the same problem solving area, namely driving the load by power transistors. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Wacknov et al. solution by adding the protection circuit for power semiconductor devices according to Kimura et al. because, as Kimura et al. state (col. 1, lines 31 – 48), the IGBT are especially vulnerable to the short circuit conditions, and therefore should have special protection against that.

Additionally, it does not disclose the trench type power semiconductor device. Kohno et al. discloses the trench IGBT (Fig. 1 and 2). Both references have the same problem solving area, namely providing the power semiconductor devices, particularly IGBT. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Wacknov et al. solution by adding the trench type IGBT according to Kohno et al., because as Kohno et al. state (col. 1, lines 18 – 24), such device has advantage of lower conducting state voltage drop and therefore, lower power dissipation.

Regarding Claims 12 and 13, Wacknov et al. disclose a hybrid electric vehicle having an internal combustion engine (element 70mn in Fig. 21), an electric motor (element 534 in Fig. 11), a transmission transmitting power from the internal combustion engine and/or the electric motor to wheels, which is inherent in the structure of the

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hybrid electric vehicle, an inverter unit (element 374 in Fig. 10) converting DC power to AC power, and a DC power storage unit (element 364 in Fig. 6), wherein the electric motor (element 10 in Fig. 2) is an AC motor driven by AC power from the inverter unit (col. 12, lines 30 – 14). As to the inverter unit being the power converter protected against short circuit, Kimura et al. disclose that subject (see Claim 11 rejection above).

### ***Response to Arguments***

Applicant's Arguments have been given careful consideration but they have been found non-convincing.

Applicant in his Remarks attacks the Kimura reference for its alleged deficiency (page 7, last paragraph – page 8, 1<sup>st</sup> paragraph), such as a possibility of the high value short circuit current. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., possibility of the high value short circuit current) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

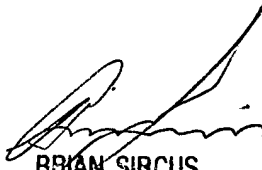
### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zeev Kitov whose current telephone number is (571) 272 - 2052. The examiner can normally be reached on 8:00 – 4:30. If attempts to reach examiner by telephone are unsuccessful, the examiner's supervisor, Brian Sircus can be reached on (571) 272 – 2800, Ext. 36. The fax phone number for organization where this application or proceedings is assigned is (571) 273-8300 for all communications.

Z.K.  
12/28/2006

  
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